Remarks and Arguments

The drawing were objected to under 37 C.F.R. 1.83(a). The examiner has argued that the drawings fail to show every feature of the invention specified in the claims. In particular, the examiner listed the following items as being missing from the drawings: "the spectrum measurement;" the "clock generator;" the "uniform resolving power;" the "delayed acceleration voltage pulse;" an "expert system;" the "R-C networks;" "means for rising over time the voltage of the acceleration voltage pulse;" and "means for moving the precursor ion selector and the post acceleration unit out of the path of the ion beam." Some of the items listed by the examiner are not shown in the drawings because they are intangible in nature. The "spectrum measurement" is not an object, but a step in a process, and is therefore not appropriate for depiction as an object in a drawing. Likewise, the "uniform resolving power" refers not to an object, but to a characteristic of the spectrometer. The same may be said for the "delayed acceleration voltage pulse." The applicant has gone as far as to use text boxes in the figures to identify where certain voltage pulses are applied, but whether or not the voltage pulse is delayed is a question of system operation, which is described in the text.

To address the examiner's concerns regarding the other items that he felt needed to be shown in the drawings, modifications have been made to Figures 1 and 2, and new drawings have been submitted herewith. In the new versions of Figure 1 and Figure 2, items described in the original patent text are now also shown schematically. Clock 16 (described in the original application text in, for example, Paragraphs 36 and 37) is shown connected electrically to a switch 17, which is the schematic embodiment of the switching function described, for example, in Paragraph 36. A pulse generator 15 is also shown in the figure, representing the operation that is described in the original application text in, for example, Paragraphs 36 and 37. A laser 11, described throughout the application text, is also shown for clarity. Since each of these items was clearly described in the text of the original specification, no new matter has been added.

Some of the other items listed under the examiner's objection to the drawings have been handled through amendments to the specification or claims. The "expert system" (described, for example, in paragraphs 40 and 60 of the original specification) is obviously part of the post-processing detector electronics. As such, an amendment has been made to Paragraph 60 to associate the expert system with the "detector electronics" shown schematically in Figures 1 and 2. Thus, this system is now appropriately depicted in the figures by virtue of that association. From the text of the application, it is quite apparent that the R-C networks would just be part of the pulse generators that are shown in Figures 1 and 2. An amendment to Paragraph 56 has been made to clarify this point, and thereby demonstrate the appropriate disclosure in the drawings of the application. With regard to the "means for rising over time the voltage of the acceleration voltage pulse," which the examiner attributes to Claim 12, it is noted Claim 12 is a method claim that recites the act of rising the voltage over time, so no tangible object is actually recited. Nevertheless, it would be apparent to anyone skilled in the art that the pulse generator 15 could be used for this purpose, and this element is therefore properly supported. The same is true for Claim 24, which recites the ability to move the precursor ion selector and the post-acceleration unit out of the path of the beam of ions, although Claim 24 has been canceled herein, thereby obviating the basis for this rejection.

With the amendments to the drawings and specification, it is believed that the drawings now show all of the claimed components necessary to support the claims. As discussed above, no new matter has been added in making these amendments. Reconsideration of the drawings under this ground for rejection is respectfully requested.

Claims 1-24 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. In particular, the examiner has stated that Claims 1-20 were method claims that failed to provide any itemized method steps. The claims of the application have been rewritten in a manner that should address this basis for objection, however, as all of the independent method claims now recite a series of method steps. With regard to

Claim 22, it was stated that the term "the delayed triggering of the precursor ion selector" lacked antecedent basis. A similar rejection was made for use of the term "the delayed triggering of the post-acceleration unit" in Claim 23. However, each of these claims has since been amended to obviate these points. Reconsideration of Claims 1-24 under these grounds for rejection is respectfully requested.

Claims 1-24 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,625,184 ("Vestal '184"). In making this rejection, the examiner has stated that Vestal '184 discloses all of the features of the claimed invention including "a clock generator 162 for applying a periodic sequence of voltage pulses to elements in the time of flight mass spectrometer to switch between the laser and the elements." However, a close analysis reveals a number of distinct differences between the present invention and the prior art of Vestal '184.

Vestal '184 discloses a mass spectrometer that uses delayed extraction of ions generated in a MALDI ion source. The generated ions are accelerated with a delay after the laser pulse, and there is an independent control of the source field up to the acceleration start and after the acceleration start. As shown in Figure 2, a laser 76 is used to irradiate the sample and matrix materials located on sample holder 70. The voltage that is connected to the sample holder depends on the position of switch 62. After the laser pulse, the switch may be used to switch between two high voltages, giving a fast change in the voltage potential on the sample holder to allow independent control before and during ion extraction.

Like Vestal '184, the present invention provides a time-of-flight mass spectrometer that using laser irradiation to generate ions that are then accelerated toward a reflector and ultimately to a detector. However, the present invention uses a clock that continuously generates a signal that may be used to trigger a desired set of voltage pulses for an acceleration electrode of the spectrometer. In a first mode, in which there is no spectrum acquisition, a switch connects the output of the clock directly to a pulse generator that responds by delivering the pulses to the electrode. In a

second mode, however, the switch connects the clock to the pulse laser to trigger a laser pulse. Upon generating the pulse, the laser generates a trigger signal to the pulse generator so as to generate the acceleration voltage pulses. Thus, the clock is in a free-running mode, and triggers the pulse generator directly until an acquisition period, at which time the clock triggers the laser which, in turn, triggers the pulse generator. In this way, pauses may be bridged without a loss in thermal and electric equilibrium.

The aforementioned features are clearly recited in applicant's claims. Claim 1, as amended, recites a method for the measurement of laser desorption mass spectra that includes providing a pulse generator that generates pulses that are delivered to an electrode of the spectrometer for delayed ion acceleration. The claim further recites that a clock signal is generated that is directed to the pulse generator during periods without spectrum acquisition, and that is directed to a laser of the system at times of spectrum acquisition. The clock signal triggers the laser which, in turn, triggers the pulse generator. Independent Claim 21 is a similar claim in apparatus form, which recites a clock that is switched between directly triggering the pulse generator or triggering the laser which, in turn, triggers the pulse generator. Claims 2, 6 and 24 have been canceled, and Claims 3-5, 7-11, 22 and 23 depend from Claims 1 and 21, respectively, so these claims inherit the limitations of their respective parent claims discussed above. Reconsideration of Claims 1-5, 7-11 and 21-23 under this ground for rejection is respectfully requested.

Claim 12 is the other independent claim of the application, and it addresses a particular feature of the invention not discussed above. For the measurement of daughter ion spectra, it would typically be necessary to adjust ion source potentials from one daughter ion spectrum to the next, since the daughter ions are derived from precursor ions that are different in each case. Therefore, the present invention controls the acceleration pulses so as to make the location of the time focus in the precursor ion selector independent of mass. This means that the sequence of delayed, time-shaped acceleration pulses can be made to run in the same way for the daughter ion spectra from one spectrum to another, without the need for additional adjustment. This feature

is recited in Claim 12, which includes providing a reflector time-of-flight mass spectrometer having a precursor ion selector between an ion source and a reflector. The claim goes on to recite performing ionization and "supplying a time-shaped acceleration voltage pulse switched on after a delay, wherein a time focus for ions of a first mass created by the delay period and the accelerating field strength is located in the precursor ion selector." Finally, Claim 12 states that the voltage of the acceleration voltage pulse is raised over time, such that the time-focus locations for ions of different masses are located at the same point, irrespective of the mass." Nowhere in Vestal '184 is there any suggestion of such a feature. Claims 13-20 depend from Claim 12 and are therefore equally unsuggested by the Vestal '184 prior art. Reconsideration of Claims 12-20 under this ground for rejection is respectfully requested.

Claims 1-24 were also rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,348,688 ("Vestal '688"). Vestal '688 discloses a tandem time-of-flight mass spectrometer that uses delayed extraction of ions following ionization. In making this rejection, the examiner has stated that Vestal '688 includes "a clock generator 162 for applying a periodic sequence of voltage pulses to elements in the time of flight mass spectrometer to switch between the laser and the elements." In the Vestal '688 patent, the element 162 is described as "a four channel delay generator" that is "started by a start pulse 150 which is synchronized with production of ions in the pulsed ion generator" (column 11, lines 11-14). As described in the subsequent text of the prior art patent, the delay generator allows for a sequence of pulses to be generated, each after a particular delay. However, nowhere in the Vestal '688 reference is there any suggestion of using a free-running clock, the output of which may be switched between the trigger for a pulse laser and the trigger for a pulse generator. Likewise, there appears to be no suggestion of using acceleration pulses that make the location of the time focus in the precursor ion selector independent of mass. As described above, these features are clearly recited in each of the claims falling under this rejection, and these claims therefore appear to be unsuggested by Vestal '688 as well. Reconsideration of Claims 1-5, 7-11 and 21-23 under this ground for rejection is respectfully requested.

Claims 1-24 were also rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,300,627 ("Koster"). The examiner provides no details regarding the basis for this rejection. However, Koster discloses a time-of-flight mass spectrometer that uses only an intermediate level of energy in an initial acceleration of the ions to allow them to decompose via metastable decomposition or collisionally induced fragmentation. The ions are then accelerated to a higher level in a second step. Again, this prior art appears to provide no suggestion of using a free-running clock, the output of which may be switched between the trigger for a pulse laser and the trigger for a pulse generator. Likewise, there appears to be no suggestion of using acceleration pulses that make the location of the time focus in the precursor ion selector independent of mass. As described above, these features are clearly recited in each of the claims falling under this rejection, and these claims therefore appear to be unsuggested by Koster as well. Reconsideration of Claims 1-5, 7-11 and 21-23 under this ground for rejection is respectfully requested.

In light of the foregoing amendments and remarks, it is respectfully requested that all the claims be allowed such that the application may be passed to issue. If it is believed that a telephone conference would help expedite prosecution of the application, the examiner is invited to call the undersigned. The Commissioner is hereby authorized to charge any fees due for the filing of this paper to applicant's attorneys' Deposit Account No. 02-3038.

Respectfully submitted

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